Organization of Advanced Learning in Mathematics Classes at a Technical University

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Abstract: The presented article is aimed at a theoretical understanding of the concept of advanced learning, as well as the experience of its organization in practice. The problem of active inclusion of students in educational activities is one of the main ones in the educational process, including applied tasks in mathematics classes at a technical university, it is possible to stimulate the mental activity of students, which contributes not only to the formation of stable knowledge on the subject, but also provides for the achievement of interdisciplinary connections, since the coordinated and interconnected teaching of subjects of the natural-mathematical cycle is an important means of forming a worldview that allows you to study the diversity and unity of the material world. Such an organization of the educational process is designed to increase practical orientation, internal motivation for learning, which contributes to the development of students' personality and ultimately the formation of a graduate's personality as a professional in a rapidly changing world, during the creation of new technologies, capable of supporting and developing the social, technological and economic system of the country, taking into account the environmental component of development. Such a specialist is ready to take responsibility both as a citizen and as a professional.

1 INTRODUCTION

In the modern world, the number of negative processes in the social, economic and environmental spheres is increasing. It is necessary not only to identify the causes of global crises, but also to develop methods and means of overcoming them, and most importantly, to find a direction to prevent unprofessional solutions in human activity, that is, to choose a vector to anticipate problems arising in society, the economy and environmental management.

The ability of a person to successfully solve problems arising in the course of his activity, to solve them professionally and creatively, directly depends on his intellectual potential, because the main factor in the development of the state is the development in proactive mode in the education system in order to train graduates who in the future are able and want to transform social society for the better, accelerate economic development, at the same time, without harming nature, they will try to preserve and increase the wealth of the country in which they were born and grew up (Efremov, 2012). In modern society, attention to education is relevant, since the future is in the hands of those who study and teach (Arzhanceva, 2006). Therefore, more and more often we turn to advanced learning of students, which meets the needs of modern society.

2 STUDY METHODS

2.1 Subject of Research

Mathematical training at a technical university is essential in fundamental engineering education, however, the costs of distance learning in the

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pandemic period affect the level of preparedness of first-year students, not only is there a lack of systemic fundamental mathematical knowledge, but also the ideas of many students about the ways and methods of obtaining them have changed. It is much easier to look at a ready-made solution on the Internet than to try to figure out the problem yourself. Therefore, there was a need to organize such a learning process that would involve the active inclusion of students' mental activity in solving applied mathematical problems, concentrating their attention on the material that falls within the scope of students' interests, first of all, it is the text of the problem that is close to the direction of professional activity chosen by students. After inclusion in the topic of the lesson, when the students understood "why", they can move on to the next stage – "how", then work out standard methods for solving problems. After mastering the methods of solving typical tasks that students can already solve on their own, you can move on to the next stage – solving tasks that require the inclusion of the full potential of mental activity, assuming its development ahead of schedule, which is the basis of advanced learning, at this stage of learning it is also effective to offer applied tasks. Thus, there was a need to identify the goals of modeling applied problems in mathematics in sufficient volume and variations.

2.2 Research Problem

The revealed contradictions made it possible to determine the topic of this study, the problem of which is the organization of advanced learning in mathematics classes at a technical university.

2.3 Purpose of the Research

The purpose of the research is to substantiate the main approaches of advanced learning and design an educational process in which learning is both a starting point and a driving force for the development of students.

3 RESEARCH METHODS

In the course of the research, methods of analysis and synthesis were used, which made it possible to identify the main trends of scientific research in the world and domestic theory and practice of advanced learning.

4 RESEARCH RESULTS

In modern psychological and pedagogical literature, several approaches to the concept of advanced learning can be distinguished. One of the approaches to the concept of advanced learning is the following:

● Advanced learning refers to the design of pedagogical activities involving the introduction of concepts and laws before they are studied according to the curriculum. Such advanced learning can be implemented at almost any level of education, starting from preschool and then can be used in higher education. The approach to advanced learning in this sense is not new, even in the last century in her pedagogical practice S.N.Lysenkova used the so-called technology of advanced prospective learning, which involves the introduction of some issues of the program at earlier stages than it was provided for in the curriculum, but in small doses (Lysenkova, 1995). This made it possible to reduce the difficulty of studying individual topics. S.N.Lysenkova referred to the basics of advanced learning:

- commented management as a method of including each student in the learning activity at each lesson (Kondrashova, 2019).

-reference diagrams, flashcards, posters on which the main conclusions obtained as a result of studying a certain topic were highlighted, which contributed to the formation of basic concepts and stable knowledge among students (Lysenkova, 1988).

Advanced learning in I.P.Volkov's technology involved the introduction of ideas about stereometric concepts at the early stages of education, even in elementary school, which could facilitate the study of a difficult section of geometry – stereometry in high school, where spatial imagination is the basic, if not the main, in solving problems.

Being a very young teacher, I was impressed by the meeting with V.F. Shatalov, who presented his approach to teaching mathematics through reference signals, while studying theory was supposed to be blocks, followed by solving practical problems, which allowed us to perceive the content of the enlarged block as a complete picture.

The second approach to the concept of "advanced learning" can be attributed to the approach in the sense of "developmental learning":

● Advanced learning, which is aimed at activating mental activity with the competent organization of the educational process. On the basis of mastering the knowledge of the material, students can move on to the next stage – development, while it is necessary to build the learning process in such a way that it is possible to introduce new elements, form new relationships, thereby ensuring development. Learning that is aimed at the development of the student and is the main goal of advanced learning. (Sirenko, 2021).

It would be necessary to dwell separately on the concept of "developmental learning", first proposed by V.V.Davydov, although the theory of developmental learning was proposed in the works of A.Disterveg, I.G.Pestalotsi, K.D.Ushinsky and other teachers, then this theory was scientifically substantiated by L.S.Vygotsky and further developed in the works of V.V.Davydov, P.Ya.Galperin, L.V.Zankov, G.K.Selevko, I.S.Yakimanskaya and others.(4) Developmental learning, in the works of these outstanding teachers, is presented as an interconnected complex of learning and development tied into one process in which learning is both a starting point and a driving force for the development of students, through their awareness of the accumulated level of knowledge sufficient to solve problems that they can solve independently (the current level of development) and the "feeling" of the level of "immediate development", when students try to solve problems that require the inclusion of all intellectual potential, thereby developing their abilities. This approach to "developmental learning" was defined by L.S. Vygotsky, in his works the scientist pointed out the relationship between learning and development, formulated a provision on two levels of mental development: the level of "immediate development" is also relevant, contributing to the development of the potential of students (Vygotskij, 2012). The provision on two levels of mental development is the theoretical basis of advanced learning. In the works of I.A.Zimnaya, it is noted that it was on the basis of L.S.Vygotsky's theoretical research that "the principle of advanced learning was formulated, which determines the effective organization of training aimed at activating, developing the mental activity of students, forming the ability to independently acquire knowledge in cooperation with adults".

Note that the content of the studied material must be above the current level, otherwise there will be no transition to development, but it cannot go beyond the "zone of immediate development", since the material will not be assimilated by students.

Thus, the intellectual development of students does not occur by itself, but in the process of educational activity. Learning goes ahead of development, outpacing, directing, accelerating the development of students' natural data, forming a set of qualities of each personality, knowledge, skills and abilities.

Both approaches to advanced learning were used in the research work. At the first stage, it is necessary to interest students by concentrating their attention on applied tasks, then offer typical tasks on the topic under study, when students cope with the methods of solving them, you can offer tasks that require a creative approach, this is where the development of mental activity is included, that is, learning turns into development, and this is advanced learning. It should be noted that at the first stage, everyone is involved in the work, since we are talking about a subject that is interesting to students, almost all of them have chosen the direction of professional activity themselves. At the second stage, some children need help and support that a teacher can provide, as well as more successful students, which contributes to the assimilation of some and the development of others of the studied material. When moving to tasks that require the inclusion of the full potential of students, it is also possible to offer applied tasks, using integrated pedagogical technologies, such as, for example, working in small groups, brainstorming, and so on. The teacher is the coordinator of the entire educational process aimed at advanced learning. For effective work, in such an organized learning process, there are obviously not enough standard methodological materials, it is necessary to prepare a large number of various applied tasks corresponding to a certain professional profile, and at various levels of complexity. Such work is carried out in our university. Within the framework of the proposed research, blocks of problems have been created in some sections of mathematics, including problems of an applied nature of the first level of complexity, then typical tasks of the first level of complexity and advanced ones and tasks requiring active inclusion of the intellectual potential of students, both typical and applied.

It should be noted that regardless of the approach, the implementation of advanced learning in the construction of the educational process is valuable for the intellectual development of each student, and hence the sustainable development of the entire education system. To be ahead means to be capable of constant, purposeful and systematic assimilation of a system of knowledge, skills, abilities, values. Relationships, orientations, norms of behavior, ways and forms of communication (Ursul, 1996).

5 RESULT DISCUSSION

The solution of issues related to the implementation of the educational process, providing for the achievement of interdisciplinary connections in teaching mathematics at a technical university, as well as stable knowledge of the discipline itself, actualized the problem of active inclusion of students in educational activities. Such inclusion of students is possible if we offer not only standard solutions, but also a sufficient number of applied tasks with physical, technical, and economic content. Undoubtedly, mathematical knowledge is necessary in almost all fields of science, industrial and social activities, since mathematics is a language in which you can write a model of the studied natural, social phenomena and using a mathematical apparatus to find a solution to the problem.

The educational value of mathematical problems is enormous. Everyone knows the statement of M.V. Lomonosov: "Mathematics should be taught only then that it puts the mind in order". Solving mathematical problems, students not only master the theoretical part, but also apply it in practice, this contributes to the formation of a special kind of mathematical thinking, including logical orientation, accuracy and conciseness of the presentation of thoughts, systematic thinking, the sequence of thoughts, and also allows you to develop personal qualities: diligence, perseverance, activity, collectivism and so on (SHkerina, Grigor'eva, Rakun'o, 2015).

Solving applied problems in mathematics classes will increase interest in the subject, since the main goal of mathematical education is its practical orientation. The inclusion of applied tasks in the content of the studied material will allow to systematize theoretical knowledge and practical skills, and will also contribute to the development of creative thinking.

According to the observations carried out within the framework of the study, it can be noted that there is a positive dynamics of learning outcomes during the organization of advanced learning in mathematics classes, but statistical processing of the results of the study is the topic of the next work, since the study continues and a representative and variable sample of data is needed for reliability.

6 CONCLUSION

Systematizing all of the above, it is possible to define advanced learning, this is such a construction of the educational process when the intellectual development of students does not occur by itself, but in the process of educational activity. Learning goes ahead of development, outpacing, directing, accelerating the development of students' natural data, forming a set of qualities of each personality, knowledge, skills and abilities.

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